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IMPRINTS OF THE HEROIDES OF OVID ON CHAUCER, THE LEGEND OF GOOD WOMEN[1]

Having observed women, Geoffrey Chaucer cast about in his books to verify his impressions. He examined Ovid. We can see him turning the leaves of Naso, scrutinizing passages which reveal the frailty or the formidability that is feminine, and to himself softly chuckling, 'So thinketh me'. Perhaps when the great English humorist looked over the peripatetic portions of the Ars Amatoria and the Remedia Amoris he put aside his Latin to go outdoors and verify Ovid. He went to London gathering-places and studied women of the crowd. He strolled from court along the Thames to Greenwich. Shrewdly he eyed knavish Greenwich, then walked back to compare scenes at court. And all the time did Chaucer, his wits whetted, defer to the amazing Roman with 'Yis, by my trouthe'.

The father of our own poetry could not long find it necessary to test the bold asseverations of the Praeceptor Amoris. It was safe to pin the foibles of the Augustan Age, word for word, on medieval English characters. It was still safer merely to repeat Ovid's stories. Unlike the Prince of the Getae whom Landor draws in one of his Conversations, Chaucer could have read his verses to Ovid without suffering the embarrassment of having the exile die shortly after. For Naso would have applauded the flattery of Geoffrey's imitations and copyings of him, that toilsome sort of work which Vergil caustically defies disparagers to attempt.

So there sits Chaucer, left forefinger running down the pages of Publius Ovidius Naso, right hand busy with his own manuscript. To see how far the ancient dominates the modern we may take the latter's apology, The Legend of Good Women, the Prologue to which tells us that the poem was written to whitewash the fair sex sullied by Chaucer's translation of the Romance of the Rose, and by his Troilus, in which Cressida proved herself no lady (these two poems had made London women seethe as the Roman matrons seethed upon reading the Art of Love. They too demanded a Remedia). Chaucer was to retract by furnishing enough instances to show that *all* men are liars, then seducers, then deserters. The poet reasoned that during the course of a few centuries manners had not changed much in that respect, that women had continued to seek snares to walk into, that in his day as well as in ancient times women were not happy until they were unhappy. Whereupon he had taken Ovid down from the shelf.

The thesis of man's perfidy was so obvious, we gather further from the Prologue, that in each case it would require only a hundred lines or two to demonstrate. These legends are on the whole topheavy. In the major part Chaucer sharpens his ax with historical background, while he concentrates his crisis in a few lines at the end where he lets fall the ax with annihilating swiftness. When the most interesting part is thus vaguely glossed over, we are left disconcerted and disappointed. Why was Chaucer so impatient? It is not significant that we have the Legend only half-completed, for, except the Troilus, Chaucer has given us no absolutely complete elaborate work. But does the hint of impatience which protrudes in every story of the Legend indicate that Chaucer disliked his task? In Cleopatra we read "for to maken shortly is the beste" (614)[2], in Thisbe "shortly of this tale for to telle" (789), in Dido "I coulde folwe, word for word, Virgyle, But it wolde lasten al to longe a whyle" (1001–1002), in Hypsipyle "As wolde god I leiser hadde, and tyme, By proces al his wowing for to ryme" (1552–1553), in Medea "Wel can Ovyde her lettre in vers endyte, Which were as now to long for me to wryte" (1678–1679), and similarly, in every one of the tales. We may conveniently account for these lines by the injunction of the Queen at the end of the Prologue to "sey shortly" (577), but that very injunction suggests impatience, and it is as if Chaucer excused his hurry in the following stories on the strength of the Queen's command. Even the added request "reherce of al hir lyf the grete" (574) does not exonerate Chaucer from lack of proportion; he dilates on the passive, and in seeming haste to finish dwarfs the active.

Wherefore it is clear that, when he looked into the Heroides, the Englishman chose not to follow the Roman structurally. Each of Naso's stories is an artistic unit. But, if we inquire just how far Chaucer planned his poem on the writings of a certain authority, then on a single work of that authority, we may gather an index of what later literature owes to that ancient of ancients who is the cyclopedia for poets. Including the legend of Alcestis, which Chaucer intended to make his final story, his project embodied twenty narratives. The first and last only, Cleopatra and Alcestis, are independent of Ovid. Cleopatra is from Boccaccio's De Claris Mulieribus; being unfamiliar with Greek, Chaucer would have drawn Alcestis from Lactantius Placidus's commentary on the Thebaid of Statius (6.381 ff.), where the story is succinctly recounted. Of the remaining nine legends written out, the English author went to the Heroides wholly or in part for his tales of Dido, Hypsipyle, Medea, Ariadne, Phyllis, and Hypermnestra. From Metamorphoses 4.55–166,

[1]For kindly suggesting to me the topic of this paper, I would express my gratitude to Professor G. L. Kittredge.

[2]Chaucer is quoted from the volume entitled The Student's Chaucer, by W. W. Skeat (Oxford University Press, 1894). The Heroides of Ovid is cited from the edition by A. Palmer (Oxford University Press, 1898).

he took Thisbe, from Metamorphoses 6, Philomela, while Fasti 2 he consulted for Lucretia.

From mention of the unwritten legends in The Man of Lawe's Prologue, in The Hous of Fame, and in The Book of the Duchesse, it is apparent that Chaucer would have continued to use Ovid in detail. In addition to Alcestis, the stories he proposed but never wrote were those of Deianira, Hermione, Hero, Helen, Briseis, Laodamia, Penelope, Polyxena, and either Lavinia or Oenone. The first seven are heroines of Ovid's Epistles, and so is Oenone. For Polyxena Chaucer would doubtless have imitated Metamorphoses 13, and he could hardly have neglected the delightful incident in Fasti 3 when he wrote of the alert never-to-have-her-home-broken-up Lavinia. Thus in sum, narrowing our consideration to the series of Letters, a form which Ovid prided himself on inventing, we see that, of the eighteen women in Ovid's Epistulae, Chaucer expected to rewrite the Legends of probably fourteen. To the story of Canace he says "fy" (The Man of Lawe's Prologue 80); Phaedra he rejects presumably for the same reason, because he will not write of incest; the tale of Sappho he probably did not have, unless his copy of Ovid was based on the Codex Francofurtanus—if it was, Chaucer might have excluded Sappho because of her alleged unnatural appetites; Cydippe fails of mention anywhere for reasons not surmisable.

In passing, we may observe that, although Chaucer meant to crown his work by drawing Alcestis as the ideal type of womanhood, we may regret hardly less that he did not leave us his version of Helen. Tennyson, in his Dream, says first of all that he read the Legend sung by the morning star of song (which star Blake with beautiful symbolism painted into the background of his Canterbury Pilgrims), but Tennyson then proceeds to make Helen the first of his Fair Women. The striking point is that of all the women sketched by Ovid, Chaucer, and Tennyson, Helen is the only one common to the scheme of all three authors. Ovid with stupendous cleverness makes his Helen queen of the subjunctive mood, letting I dare not wait upon I would (Heroides 17). What she does with Latin in her letter makes other tongues sounding brass. Tennyson devotes to Helen the most famous pair of lines in the poem: "A daughter of the gods, divinely tall, And most divinely fair". Would we not give much to have Chaucer's expansion of his topic phrase "The teres of Eleyne" (M. L. Prol. 70), set down when he projected his tentative list of heroines for the Legend.

Dominating the Legend, then, not only as it was planned, but as it has come to us, half written, is the Heroides. The relations of those six Ovidian Legends in Chaucer to their Latin originals we are to examine. In the letter of Dido (Heroides 7), Ovid himself has Vergil in mind, and consequently Chaucer could not escape from Vergilian coloring even when after about 400 lines of preliminary detail he rushes to an Ovidian finish. However, the subtle pleading of Dido, her piling up of excuses, Chaucer was too keen a student of women's motives and too careful a disciple of Ovid to let pass. Both authors make Dido tell Aeneas that she fears the other suitors, make her threaten to abase herself to any condition if he would not acknowledge her as bride, make her threaten suicide. Finally, Dido pleads, in Chaucer (1323), "I am with childe, and yive my child his lyf", after Ovid's *pro spe coniugii tempora parva peto* (Heroides 7.178). Here is the climax of Dido's, or any woman's, appeal.

Having selected this trump card from Ovid's pack of tricks, Chaucer reverts to Vergil for the pyre scene, but, as if he needed more of Naso to round out the legend, the borrower translates the first eight lines of the Epistle and tacks them on for an epilogue—"before that she deyde, She wroot a lettre anoon" (1353–1354). The effect Chaucer gives is so modern that it proves him a born reporter: 'a letter was found in the suicide's room'. Then, after he has given the headlines, the author stops, and recommends Ovid if the reader be morbid enough to pry into further details (1366–1367).

The Heroides naturally are all written after the fact. The desertion has taken place. Quite different is Chaucer's simple narrative from this direct address, although in Hypsipyle he too begins in the vocative style. There is a three-cornered interest in both Ovid and Chaucer: upon the one hand we have Medea, *barbara venefica. . .barbara paelex* (Heroides 6.19, 81), whom Hypsipyle uses as breakwater when she tries to reach Jason; upon the other, Chaucer gives us Hercules in the rôle of John Alden, except that Hypsipyle does not ask Hercules to speak for himself. And the strong man's panegyric of his friend—"half so trewe a man ther nas of love Under the cope of heaven" (1526–1527)—would shame a funeral oration. Speedy and ruthless betrayal eventuates, for Chaucer is already thinking of Jason's next escapade, with Medea. But in Ovid the leader of the Argonauts dallies until the third year before he departs, gently.

How does Chaucer heighten Hypsipyle's resentment? She must kill her children. Mention of the children in the Epistle, however, serves quite another motive: while Dido speaks of her child in order to keep Aeneas back, it is in order to *get* Jason back that Hypsipyle so appealingly dwells on her twin babes, very like their father except *fallere non norunt* (Heroides 6.124). As Chaucer's heroine was abandoned ruthlessly, ruthlessly she resolves to act. To suit his tempo, Chaucer adapts. Ovid's Hypsipyle, more feminine, through two-thirds of her letter drips vitriol against Medea, sputters and rails like Shakespeare's Cleopatra against Octavia, and then melts into tenderness over her children only to check herself with *plus est Medea noverca; Medeae faciunt ad scelus omne manus* (127–128), and to end by shrieking a curse upon her Colchian rival.

Conveniently and more clearly the English versions of Hypsipyle and of Medea are linked, as Parts I and II of one legend, being merely consecutive episodes in the adventures of Jason. There is no reason obvious for the irregular order of the Heroides (Hypsipyle is VI, Medea XII). Like Hypsipyle, Medea in her turn is racked by jealousy. While Hypsipyle ends her

letter with a curse, Medea culminates with a threat. The latter parades a long succession of benefits forgot, a monotonous Jeremiad which would make Jason turn with a yawn to the last page just to see how she finishes. By following this reminiscent style throughout the Heroides Ovid maintains a certain unity and explicitness for the series, but he is less real than Chaucer, who rapidly tells a story by minimizing the dialogue.

As we study the Englishman's attack on the material of his chief source, we notice his predilection for choosing vivid lines from special portions. He likes the luminous details he finds at the openings of the Heroides, and moreover he likes to append these bits as envoys to his Legends. Ovid (Heroides 12.11–12) has Medea bemoan her trust in Jason's golden locks, silver tongue, and winsome manners—a fatal combination. Chaucer transcribes: "Why lyked me thy yelow heer to see. . .thy youthe and thy fairnesse, And of thy tonge the infinit graciousnesse?" (1672–1675). And in immediate conclusion Chaucer advises his readers, as elsewhere, to see Ovid for further information (1678–1679). Worth noting too, another point the Latin makes at the outset and which Chaucer snaps up, is the unceasing world-custom, the matter of hospitality. At the purple couches of the dinner table, with Aeetes presiding, Medea meets Jason, and she writes, *et vidi et perii* (Heroides 12.33), for, as Chaucer gives the reason, Jason "coude of love al craft. . .With-oute boke" (1607–1608).

Ovid is less real only in so far as he is less natural in the content of the Epistles, in particular the epistle of Medea now being considered. At no few junctures of her lament we can hear Jason remonstrate, 'Why go into all that?' Whether a letter be an accusation or a plea, the writer is not likely to elaborate on happenings only too well known to her correspondent, and at the time inconvenient for him to remember. Nevertheless, what Ovid loses in style and probability he more than makes up in vividness. Chaucer concentrates on the relations of Medea and Jason, but he omits the drama for which Ovid provides lines that paint an enduring picture, as, Insopor ecce vigil squamis crepitantibus horrens sibilat et torto pectore verrit humum! (Heroides 12.101–102)[3]. There we have as grisly a scene as Vergil gives us when the serpents writhe toward Laocoon. Now in the Legend in English, in the verses, "she hath taught him how he shal nat faile The flees to winne. . .Right through the sleight of her enchantement" (1646–1650), and in the very next line (1651), "Now hath Iasoun the flees, and hoom is went", note how we miss visualization of the real event. On the ground of being expeditious Chaucer pursues rather a Cook's tour method, eliminating all but the actual love story. The question arises, Would not the abandoned Medea call up more pity if Chaucer had made us see what her help meant when Jason met the dragon?

In high contrast to Medea is the character of Ariadne. Both authors happily appear in this story at their best. Tenth in the series of the Heroides, Ariadne writes with the most stirring and most genuine pleading in any Epistle since the second, that of Phyllis. While Chaucer gives us the more engaging narrative, with Phaedra and Ariadne prettily balancing the intrigue enacted by Hercules and Jason in the Hypsipyle legend, Ovid quite as skilfully rises to a chance to be simple and emphatic, omitting all mention of any one save the decamping Theseus, and leaving Ariadne forlorn on a desert isle. For Naso, this story typifies what we might call the 'hair-tearing series'; all his heroines weep *capillis diffusis*, or *effusis*, *demissis*, *passis*, *laniatis*, but the plight of Ariadne, sola. . .mare prospiciens in saxo frigida sedi (Heroides 10.47–49), is the story of dereliction which has been retold down through the ages.

Wherein does Ovid make the strength of Ariadne's appeal? She is writing a profoundly touching love-letter. Unlike several of the other heroines, she is not vindictive. At the last she begs simply that Theseus turn about his ship and sail back to her. Only ten lines does Ariadne devote to recounting matters of which her lover was previously aware, certain incidents about the labyrinth. Who would not be moved by a recital of the feelings of one he had left alone, the awakening, the terror of solitude, nightfall and the echoing rocks, the search over mountains and amid bushes; non hominum video, non ego facta boum (10.60)[4]. She realizes that she has been betrayed, yet she hopes to rouse his pity through the love he once professed. Now Chaucer, employing his usual method, takes no information for granted on the part of his reader, but he gives all the antecedent circumstances, except that here again, as in the case of Jason and the dragon, the dramatic combat between Theseus and the Minotaur is passed over with "forth un-to this Minotaur he goeth, And by the teching of this Adriane He overcom this beste, and was his bane" (2145–2147). However, this lack is largely atoned for by the magnificent rapidity of the following lines depicting the flight of Theseus with Ariadne and Phaedra, the loading of the treasure, the stop at Aegina, the stop at the isle and desertion of Ariadne "for that, her suster fairer was than she" (2172), the arrival home so hasty that Theseus had forgotten to change his black sails to white, and the consequent drowning of his father—all in about twenty-five lines. So far Chaucer has taken his story mainly from Metamorphoses 8.

Turning now to the Heroides, in accord with his habit, to find material for the conclusion of his legend, Chaucer from this point to the end packs in lines from Ovid, fitting them vividly, naturally, and with no infringement on probability. The hollow rocks mock Ariadne's call, the shining moon discovers to her no other human being, she climbs the mountain. "Her kerchef on a pole up stikked she" (2203) is Chaucer's version of *candidaque inposui longae velamina virgae*. However Chaucer may have divided the interest by his picture of the conspiring Phaedra (not mentioned by Ovid) sailing away with Theseus, he trains your attention finally on Ariadne, and Phaedra you have forgotten. In the English, then, the legend possesses the fascination of a story embodying a complete plot;

[3] I follow the MSS. here.

[4] Compare here Catullus 64.164–170.

in the Latin, the Epistle conveys the heightened poignancy of an exquisitely pathetic incident.

About a third of the Heroides are written by distressed hostesses who were so imprudent as to take seriously the man who is travelling. Of those in this predicament, in their eagerness for which women still whisper 'I will ne'er consent', we may mention Dido, Medea, Helen, perhaps Hero, Hypsipyle, of course Ariadne, and conspicuously Phyllis (Heroides 2). The tempo of Phyllis's letter to Demophoon is slower, the effect sadder, the pleading pierces deeper than in the case of Ariadne. One reason is that Phyllis is a creature of the city—she could figure in the newspapers, whereas a romantic novel would claim Ariadne and her island: that is only a story. Yet Phyllis is not cast away, as was Minos's daughter, on an uninhabited shore. But Chaucer, consulting either the Metamorphoses or the Ars Amatoria, reminds us that Bacchus rescued Ariadne and hung up her crown in the sky. You are tempted to suggest to Phyllis that women in her circumstances may escape from being victimized by polygamy if they would embark upon polyandry. And according to a quatrain which I translate from the Palatine Anthology, Book 5 (Cycle of Agathias, CCLXIV), the young queen did rather tire of waiting:

> The eyes of Phyllis swept the sea,
> Faithless her wandering betrothed!
> Now, I, Demophoon, tread the strand
> For faithless Phyllis; where is she?

Sprinkled through the Phyllis legend, in distribution rather different from what Chaucer has employed previously, lines gleam out from Ovid like lilies in a pond. Perhaps this dispersion is the more noticeable because of a sort of refrain which Chaucer uses. He picks up a familiar line which Phyllis aims at her lover, *heredem patriae. . .fraudis* (2.78), and in paraphrase interweaves it six times, though Ovid himself in no way repeats the epithet. Chaucer, however, rings changes on the chip-of-the-old-block idea, as "wikked fruit cometh of a wikked tree" (2395), "fals of love; hit com him of nature" (2447), "the same path hath gon That dide his false fader Theseus" (2463–2464). When he imitates, Chaucer has an unerring eye for selecting the eternal. Grist for him are all the world-old vows which Ovid has beguiling man make to woman. In verses 49–54 the Roman expert enumerates the inducements: credidimus blandis. . .verbis, credidimus generi nominibusque tuis, credidimus lacrimis,. . .dis quoque credidimus. And Geoffrey, nodding his approval, puts down, "To moche trusted I. . .Upon your linage and your faire tonge, And on your teres falsly out y-wronge" (2525–2527), and this excellent material the English genius has the wisdom to expand.

Toward the end of the Epistle, Phyllis deliberates on methods of suicide—drowning, poison, the sword, hanging. Chaucer mentions only hanging, the method Phyllis chose, but he does not give her pretty reason for the choice: colla quoque, infidis quia se nectenda lacertis praebuerunt, laqueis implicuyisse lubet (141–142). After the manner of narration he pursues in other legends, here too Chaucer unfolds the story rapidly to the death of the heroine: then he turns a corner with his post-mortem beginning "But to him first she wroot" (2487). From this point on the heaviest borrowings from the Heroides usually occur. It should be remarked, however, that Chaucer jumps back and forth with reference to Ovid as indeterminately as a grasshopper; there is no continuous chronological borrowing, and it is Chaucer's very indifference to chronology that contributes mightily to the hold he keeps upon his readers. When he comes to the last line of his Phyllis legend, he roguishly writes as if he suddenly felt his dicta to be no less authoritative than those of Naso himself, for he thus instructs women: "trusteth, as in love, no man but me". In other words, Ego sum praeceptor Amoris. Rare company for each other, Naso and Geoffrey. May they be cronies in the world beyond!

The last of the Legends in English which depend directly upon the Heroides is the story of Hypermnestra. Here again the Ovidian part, not all, but mainly, is found in the final fifty lines. In the simple straightforward narrative of Chaucer the heroine writes no letter; in fact, most of the frame of the epistle could be fittingly appended to Chaucer's version, which ends (unfinished) with the flight of Lynceus, as an analysis of Hypermnestra's agonies when she lies in prison, torn between the fears that her bridegroom has abandoned her or that her father may kill her. These two stories may be better examined in the large than by comparing isolated lines. With nice discernment in literary emphasis Chaucer quickly drops all reference to the forty-nine sisters so that he can focus interest on Hypermnestra. She, however, in Ovid automatically gathers to herself this interest because as heroine she tells the story. From the point of view of Lynceus the particulars are not twice told, for, as Hypermnestra reminds him, she urged, "Dum nox sinit, effuge" dixi; "dum nox atra sinit"; tu fugis, ipsa moror, or, as Chaucer puts it (2705), "Out at this goter, or that hit be day!" Except for that very brief scene, Lynceus knows little of the situation, and nothing of its consequences. How does Chaucer proceed to bring this source material into conformity with his theme?

With a steady eye on his stage-setting, the Englishman makes somewhat more of the marriage feast, of which the pomp, panoply, and merrymaking were extravagantly developed in his own medieval time. More significant, Chaucer gives Egiste about forty lines in which the king commands his daughter to cut her husband's throat (2625–2671). In the light of this scene, so shattering to Hypermnestra, her ultimate disobedience makes her the greater heroine. Ovid on the other hand supplies the same situation indirectly and without much force, comparatively, since the princess reproduces her father's bidding in her own words. But Chaucer departs completely from Ovid, indeed from any known source, in the final scene when Lynceus escapes. According to the Latin version Hypermnestra voluntarily stays behind, or at all events she makes no effort to flee with her timorous spouse, whereas in the English version the bridegroom is con-

temptible to the taste of the most militant of Geoffrey's women readers, for the craven wretch, whom his wife not only warned but assisted to squirm through the window, speedily outruns her. Hypermnestra is caught, literally nabbed, by her bloodthirsty father. If at this point we made any observations about Aeneas losing Creusa, we should refer to that act as noble.

The Legend of Good Women is called a fragment. It is. But we must grant that Chaucer left off work at a high-water mark, considering the purpose with which he set out, to exalt women as true and to give men their 'come-uppance'. And of the miscreant lovers whose transgressions Chaucer left unwritten it is extremely doubtful if he had made any of them as dastardly as Lynceus, except Admetus. Only a mountain measures the difference in loftiness of moral character between Alcestis and her husband, though this difference was not so marked in the age of Euripides as in Chaucer's day and in our own time.

Boundless ease and simplicity in narrative we find in our medieval author quite as notably as in our ancient, but does Chaucer always rightly estimate his proportions, does he adequately illuminate the action at its crucial points? With disturbing iteration he says 'Go to Naso'. The trick recalls that vexing makeshift in the Old Testament: "Now the rest of the acts of Ahaziah which he did, are they not written in the book of the chronicles of the Kings of Israel?" Human inertia rebels against such injunctions. Chaucer constantly makes excuses for omitting details; to give them "nere but los of tyme", he protests. Concerning Ovid, we may say there exists a general shortcoming which is not precisely a structural defect, but which lies rather in the selection of proper material for a letter. An appeal is none too alluring, a reproof is none too painful, if it chiefly recalls to its reader a mass of unsavory happenings he is anxious to forget.

The Vicar of Wakefield's son Moses sagely remarks, "The Roman poet <Ovid> understands the use of contrast, and upon that figure artfully managed all strength in the pathetic depends". We can at once introduce Chaucer to Ovid as a congenial acquaintance. Power in characterization develops from a sense of contrast, and in English at least Chaucer need hand the palm to none but Shakespeare as a creator of characters. It is scarcely profitable to speculate whether Chaucer could have written double Heroides as successfully as Ovid did, but we may submit that in these pairs of letters which demand that sharp shift in viewpoint we can find the ultimate proof that contrast, to Ovid, was no unvanquished art. And assuredly The Legend of Good Women carries enough pathos to catch the sympathies even of the sex it belabors. Who can be more pathetic than Chaucer's Hypermnestra, to whom the evil returned may be said to have been directly proportionate to the good she imparted? As for Ovid, what can arouse more pity than Ariadne's last cry for Theseus to turn back his ship, already fading into the horizon? Relative originality aside, indeed both writers were born with keys to the human heart.

Though the Heroides as an invention was an experiment in women, it flattered women, who do not refuse to see themselves pictured as the slighted sex. Yet, after reading of their ill-treatment at the hands of such 'brutes', women with adorable inconsistency think none the less of men, and the author himself they love only the more since he 'understands' them. Lady Mary Wortley Montagu (agreeing with Ben Jonson in The Poetaster as to the cause of Ovid's banishment), when twelve years old, was moved to write in imitation of the Heroides an epistle from Julia to Ovid. The precocious and admiring young lady has Julia absolve the prince of erotics, heap all blame upon herself, and predict for Ovid divine aid:

> Apollo will protect his favorite son,
> And all the little Loves unto thy succour run.
> The Loves and Muses, in thy prayer shall join,
> And all their wishes and their vows be thine.

As we read Ovid from letter to letter and notice how he sustains the pace, how he accumulates endless variety of incident to offset the monotone of the querulous heroines, we feel that what chiefly propels him is enthusiasm for his new departure. These letters pick up momentum. Chaucer on the other hand appears in a hurry to finish a labor not altogether to his liking. Sometimes you suspect that Geoffrey would have preferred to write of nineteen abandoned men; you suspect that the monotony of his legends weighed heavily enough to make him, for that very reason, break off where he did. The troubles of women 'who have suffered' did not divert Chaucer as they diverted Ovid, for Chaucer was more masculine in temperament. We can hardly imagine Chaucer writing, for example, a treatise on the care of the complexion, even had he lived in Ovid's time. Notwithstanding these reflections, genius, in both our authors, shines through in this: if Chaucer lacked enthusiasm, he still wrought a lively and masterly poem; if Ovid lacked experience with his invention, he still established a new literary form for all time.

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REVIEW

Mathematics. By David Eugene Smith. Boston: Marshall Jones Company (1923). Pp. x + 175. $1.50.

It is needless to point out the difficulties that beset one who undertakes to write on the subject treated in this work (one of the series entitled Our Debt to Greece and Rome). If I make any suggestions as to possible improvements, I do so with recognition of the fact that no two persons would agree as to what should be told and what omitted. The author, who is Professor of Mathematics in Teachers College, Columbia University, has done his work as successfully as could be expected of anyone.

Before I commence an analysis of the book, some general remarks seem desirable.

One useful and interesting feature is the explanation of the names given to mathematical operations and geometrical figures. Occasionally other matters of a linguistic nature are discussed. One or two re-

marks of this sort are not clear, as on page 35, "Instead of speaking of a half, they <the Romans> used the word *semis*. . .". On page 150, the connecting of a physician's 'prescription' with the *perscriptio* of banking seems unsatisfactory.

Those acquainted with the qualifications of the author will justify my failure to verify statements. One of these, however, on page 6, to the effect that we are ignorant of the mathematics of ancient India, is not consistent with more correct statements elsewhere, implying that we know a good deal about Indian mathematics. Moritz Cantor, in his Vorlesungen über Geschichte der Mathematik, and H. G. Zeuthen in his book, Die Lehre von den Kegelschnitten im Altertum, discuss the question of Greek influence on the Indian mathematicians.

The dates are given in round numbers sufficiently accurate for the purpose. The date of Ptolemy Soter, however, as founder of the Alexandrian Library, which is put at about 325 B. C., would better be placed at about 320, as Alexander died in 323.

This review attempts only to give some idea of the character of the book, which can perhaps be done best by giving a syllabus of its contents, with a few comments.

The contents are as follows:

Introduction, by Sir Thomas Little Heath <v-viii>; I. Preliminary Survey <1–13: 1. Leading Contributions of Greece, [1–9], 2. Leading Contributions of Rome [9–13]>; II. The Contributions in Detail <14–89: 1. Logistic [14–32], 2. Artificial Numbers [32–38], 3. Arithmetic [38–52], 4. Elementary Geometry [52–60], 5. Higher Geometry [60–65], 6. Algebra [65–84], 7. Trigonometry [84–89]>; III. Influence of the Contributions <90–159: 1. Logistic [90–101], 2. Influence on Methods of Calculation [101–108], 3. Artificial Numbers [108–112], 4. Arithmetic [112–115], 5. Elementary Geometry [115–123], 6. Higher Geometry [123–127], 7. Algebra [128–130], 8. Trigonometry [130–131], 9. The Calculus [132–136], 10. Applied Mathematics [136–150], 11. The Teaching of Mathematics [151–159]>; IV. Conclusion <160–164>; Notes <167>; Bibliography <168>; Index <171–175>.

In the Introduction, Sir Thomas Little Heath, with his well-known thorough qualifications and his zeal for Greek and mathematics, emphasizes the fact that, to comprehend the history of mathematics and to understand the Greek genius in general, an acquaintance with the original works is necessary, and that the great Greek masters regarded mathematics as primarily useful in training the mind and enabling the soul to obtain a glimpse of the truth, the practical application to every-day problems being considered quite secondary. He quotes Plato and cites the example of Archimedes to illustrate this fact. He might also have cited Apollonius, who says of some of his propositions that, if for no other reason, they are useful on account of the demonstrations, and adds: 'There are many things in mathematics that we sanction because of nothing else'.

The Preliminary Survey gives in concise form an excellent portrayal well designed to enable the general reader to comprehend the nature of the subject and the incalculable contribution of Greece to modern science, art, and general civilization. In respect to mathematics the case is very different as concerns Rome. The Romans added nothing to pure mathematics, caring only for the application of the science, chiefly practical arithmetic and surveying, but of these they made more use than did the Greeks, as is attested by the great bridges, aqueducts, and the like. I would here call attention to the fact that the Romans were aided by Greeks in some known instances. It is an interesting question to what extent such aid was received in general.

Turning now to The Contributions in Detail, we find Professor Smith saying that 'logistic' is to be distinguished from arithmetic, the former being the art of computation or reckoning, the latter the science of numbers, treating of what we call their proportions. I would, however, note that Plato does not maintain this distinction, but uses λογιστική, τὸ λογιστικόν, and οἱ λογιστικοί of both the art and the science, calling it a *mathema*.

An account is given of the earlier Greek and the Roman notation. The history of the latter is not given, because of the space it would require, which is regrettable, since there are misconceptions concerning its origin, such as that M for 1,000 was the initial letter of *mille*.

The difficulties in performing operations with Greek and Roman notation are here illustrated. The later Greek notation also is described and its employment is illustrated.

An account is given of mechanical aids that were employed partly to facilitate computation and partly because of lack of writing material in an age when there was neither paper nor slates. Considerable space is given to the abacus in its various forms in different countries.

Finger notation, that is the method of indicating numbers by means of the fingers, is mentioned and allusions to it are cited.

Under Artificial Numbers the author treats common fractions (formerly called 'vulgar' fractions, as they now are in England). With unity for numerator there was no difficulty; but the difficulties in other cases led the ancients to invent smaller units as parts of the main unit, just as we say 'nine inches' instead of 'three-fourths of a foot'. This method was applied to all kinds of measures. The Romans were partial to twelve as the basis of divisions, probably because it was itself divisible by 2, 3, 4, and 6.

The Greeks and the Romans, however, could represent fractions by means of proportions, as for instance, 15:17 for fifteen-seventeenths. Other devices of the Greeks are here explained.

The Greek astronomers borrowed from the Babylonians the use of 60 (perhaps chosen because divisible by 2, 3, 4, 5, 6, etc.) as a basis for the division of the parts of a circle. Assuming 60 as radius and 3 as the value of π, they obtained diameter 120 and circumference 360; hence our 360 degrees, with the strange ratio of 60 for minutes and seconds, and the still more strange extension of this ratio to the divisions of an hour.

In the Middle Ages these sexagesimal fractions were

known as physical or astronomical fractions, and ordinary fractions were called *fractiones vulgares*, whence our 'common' or 'vulgar' fractions. I venture to suggest the possibility that 60 was originally chosen because it is the product of 3, 4, and 5, denoting the sides of the most familiar commensurable right-angled triangle, widely known and employed by Plato in forming his mystic 'geometrical number', justly criticized by Aristotle.

Arithmetic, the science of numbers, is next taken up, and its origin and early history, especially among the Greeks, are narrated. To summarize would be useless. One subject of investigation may be specially mentioned, as it has engaged the attention of many modern mathematicians—'perfect numbers', that is, numbers which, like 6, are equal to the sum of their aliquot parts, including unity.

Euclid (c. 300 B. C.) was the first to develop the number theory, to which he devoted much space. Some illustrations are here cited from him. Eratosthenes (c. 230 B. C.) worked on prime numbers, but his method was purely experimental. Archimedes (c. 225 B. C.) developed a scheme of counting by octads, that is, the eighth power of ten. I may note that for him this was a myriad of myriads and that, by this scheme (using erroneous data), he expressed in a few words the number of grains of sand the 'world' (solar system) would contain if it were all sand.

Of later Greek and Roman arithmeticians are mentioned Nicomachus (c. 100), Theon (c. 125), and Iamblichus (c. 325). Boethius (480–524), without contributing anything original, wrote his De Institutione Arithmetica Libri Duo, which, partly because the Church claimed him as a martyr, dominated the teaching of the theory of numbers in all the Schools of Christian Europe for a thousand years.

The original meaning of the word geometry, 'earth-measuring', or 'land-measuring', describes the earliest geometry, developed by the Babylonians and the Egyptians. The Greeks, beginning with Thales (c. 575 B. C.), created the science of geometry. Three periods of the development are named: (1) The Period of Demonstration: Plato and his school; (2) The Period of Discovery: the Pythagoreans; (3) The Period of Exposition: Leon (c. 375 B. C.), Theudius (c. 360 B. C.), and Euclid (c. 300 B. C.), whose Elements, the greatest text-book ever written, embraced most of the pure mathematics. The merits of this work are here enumerated.

By the term higher geometry is meant that branch which, in drawing figures, requires other instruments than the compasses and the ungraded ruler. Even before Plato, Hippias of Elis (c. 425 B. C.) is believed to have invented the quadratrix, afterwards studied by Deinostratus (c. 350 B. C.). I would note that this curve was invented to trisect the angle and it was afterwards discovered that, if the curve could be drawn, it could be made to square the circle—a fact that has misled some into the belief that the two problems are essentially identical, while in fact an angle can be trisected in several ways even by means of a hyperbola.

Conic sections, according to an unsupported but plausible tradition, were first studied by Menaechmus (c. 360 B. C.). These curves were at first obtained by cutting the surface of cones with a plane perpendicular to one of the elements, the acute-angled cone giving the ellipse, the right-angled cone the parabola, the obtuse-angled the hyperbola.

Archimedes studied the parabola and even paraboloids and ellipsoids of revolution.

Apollonius of Perga was the greatest writer on conic sections. He will be mentioned more at length farther on.

Brief mention is made of higher plane curves discovered or invented by the Greeks, such as the conchoid of Nicomedes, the spiral of Archimedes, and the cissoid of Diocles.

The nature of algebra is explained, and it is pointed out that the difference between modern algebra, with its symbols and notation, and ancient algebra, even when only words are used, does not constitute an essential difference. The name is Arabic, being a modification of the first word in the title of a work written by Mohammed Ibn Musa, al-Khowârizmi (that is, the Khowarizmian, usually called simply Alkhowarizmi), about A. D. 820. In Latin translations it was written *algebra*, without the rest of the title[1]. I may add that the book is said to be still used in Arabian Schools.

Processes of an algebraic nature were known in Egypt and possibly in China long before the Greek mathematics had a beginning. In Greece, Thales seems to have laid the foundations of this branch. Pythagoras advanced the science by elaborating the idea of a proportion, which is virtually an equation. The solution of problems, however, was accomplished by means of geometric figures. Some illustrations are here given, as for instance, the discovery of Hippocrates, in the fifth century B. C., that the cube can be doubled by finding two mean proportionals between two lines, one twice as long as the other, algebraic proof of which is given.

The geometric method was gradually replaced by a crude algebraic method, and Heron (about the beginning of the Christian era) seems to have solved some quadratic equations of considerable complexity in which geometry cannot be employed.

With Diophantus (c. 275) the algebraic method definitely replaced the geometric method, and his symbolism was as usable as any that were devised before the sixteenth century, which fact, with his skill in the solution of quadratic equations, causes him to be regarded as the Father of Algebra.

Indeterminate equations were no doubt known before the Greek period, but those of the quadratic form were probably first studied by Pythagoras, followed by Plato. Diophantus did most
Some interesting illustrations are give
Cubic equations received the att

[1]For an edition of Robert of Chester's Latin translation of the Algebra of Al-Khowarismi, by L. C. Karpinski, see THE CLASSICAL WEEKLY 11.112. C. K.

Greeks. Some instances of special problems are cited, which they solved or tried to solve.

Elementary series, some knowledge of which was received from the Babylonians and the Egyptians, were more thoroughly studied by the Greeks, who originated the investigation of infinite series. Examples are cited or mentioned, including the summing of an infinite converging series by Archimedes in finding the area enclosed by part of a parabola.

Higher series were first investigated by the Greeks. An illustration is cited from Archimedes.

In its etymological sense the term trigonometry goes back to the third millennium B. C. in Egypt, but this is not what we mean by the name to-day.

Thales measured the height of a pyramid by means of its shadow.

Aristarchus (c. 260 B. C.), or possibly Eudoxus (c. 370 B. C.), attempted to find the distance to the sun and the moon and the size of these bodies, using correct methods, but having instruments too crude to obtain useful results.

Heron did work that some consider trigonometric. Menelaus (c. 100) carefully studied spherical triangles and wrote six books on chords of arcs, and a work on spherics, and was the author of the Regula Sex Quantitatum of the Middle Ages. The rule may have originated earlier, but it is certainly Greek.

Ptolemy (c. 150) computed a new table of chords, and made an advance by using in some cases the half-chord, that is, the sine of half the angle. He knew the law of the sides and the sines of the opposite angles. He studied the right-angled spherical triangle and knew some of the formulae, but expressed them in words.

Though the part of the book called Influence of the Contributions is the essential part of the work, it must be very briefly mentioned here. The reader will anticipate many of the conclusions, but will be surprised at some of the facts he will learn, unless he is already versed in the history of mathematics.

Under Finger Symbolism two works are mentioned the titles of which are rather strange. One, by Nicholas Rhabdas (c. 1340), Ἔκφρασις Τοῦ Δακτυλικοῦ Μέτρου (107), would naturally be taken for a work on dactylic verse. The other, by Johann Thurnmayer (1522), is entitled in the text Abacus atque Vetustissima, Veterum Latinorum per Digitos Manusque Numerandi. Here either *atque* should be *Arsque*, or else *Ars* has dropped out after *Vetustissima*; in any case the comma is wrong.

Concerning algebra and geometry there are some special topics treated on which I wish to add a few remarks.

Whether Mohammed Ibn Musa obtained his algebra from the Greeks or from the Indians or he himself originated it, there is a difference of opinion. The view taken in our book, that he obtained it essentially from the Greeks, seems justified. It seems almost certain that his geometric proofs of the correctness of his rules were taken from Euclid, whether there was any Arabic translation or not at that time. But what is specially interesting is the fact that, about two centuries later, Omar Ibn Ibrahim al-Khayyami (better known as Omar Khayyam) in the Introduction to his great work on algebra, warns the would-be student that, for the elementary part, he must be familiar with Euclid's Elements, and, for the advanced part, with the two books (first and second) of Apollonius on Conic Sections.

Had there been space, it would have been well to state and explain more fully just what Descartes did whereby he created modern mathematics, and to produce clear proofs with illustrations that coordinate axes were used by Apollonius. In this connection it is noteworthy that Apollonius, having shown that, by changing the position of the cutting plane, all the conic sections can be cut on the surface of any regular cone, he changed the names, and that the names he adopted, still used to-day, ellipse, parabola, hyperbola, were derived from the geometric solutions or representations (found in Euclid) of what we call the equations of these curves, when the coefficient of y square is reduced to unity. The simplest illustration is when y square is equal to nx. Here the square on y is deployed (παραβάλλω) on the line n; hence παραβολή, 'deployment'. If to y is assigned a particular value, x is obtained by simple division, and hence in Greek arithmetic παραβολή means 'division'.

I would also call attention to the fact that, just as the name of Copernicus is given to the heliocentric doctrine of the solar system, although he himself ascribes it to Aristarchus, so the most important property common to all the conic sections, including the circle, is called 'Newton's Theorem', although Newton himself says he got it from the ancients, and it is fully demonstrated in the extant work of Apollonius.

The Conclusion is a fine tribute to Greek mathematical genius, a tribute that would apply equally to Greek genius in several other spheres of human attainment.

To the list of works named in the Bibliography I should add H. G. Zeuthen, Die Lehre von den Kegelschnitten im Altertum, and Ludwig Matthiessen, Grundzüge der Antiken und Modernen Algebra der Litteralen Gleichungen.

It is to be hoped that the pupils in our High Schools will be encouraged to read this excellent book, especially the General Survey and the Conclusion.

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